Cooperative Research: Research on Dynamic Stabiilty Analysis

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Abstract

The aircraft dynamic stability is an essential information for evaluating the flight stability and designing the aircraft maneuver control systems. But there are limitations for the textbook-based estimations and the wind tunnel tests and, therefore, the CFD-based stability analysis is expected to dissolve the limitations. Our objective in this research is to apply FaSTAR, a high-speed solver for compressible flow developed in JAXA, for predicting the dynamic derivatives to validate the accuracy of the code.

Reasons and benefits of using JAXA Supercomputer System

The prediction for the dynamic derivatives requires quite a bit of numerical simulations. The vast computational resources provided by JSS allow us to enhance the process and make it much faster than we do them on desktop computers.

Achievements of the Year

We conducted numercal computation with DES (Detached Edddy Simulation) method to simulate unsteady flow over a Standard Dynamics Model (SDM) and predicted the dynamic derivatives. The votex structure over the SDM model (figure 1) indicates that the unsteady flow over the main wing is simulated in the present simulation. We will be working to evaluate the capability of our numerical method by comparing the numerical and experimental results.

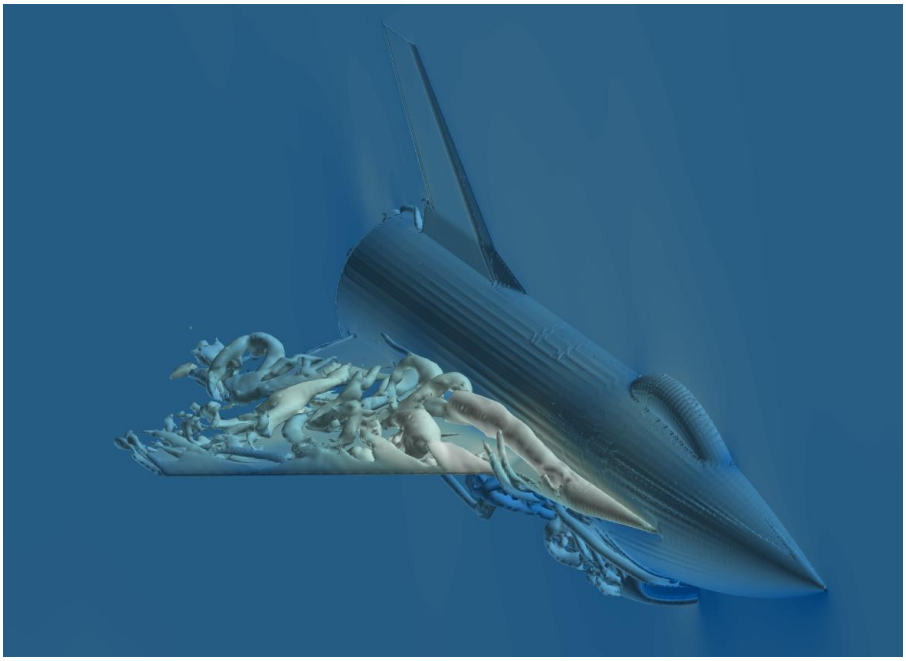

Fig. 1: Pressure field and vortex structure over the SDM model

Publications

- Non peer-reviewed papers

Yoimi Kojima, Atsushi Hashimoto, Ichiro Maeda, "Dynamic stability analysis on a Standard Dynamics Model with URANS method", 59th Aircraft Symposium, Dec. 2021

- Oral Presentations

Yoimi Kojima, Atsushi Hashimoto, Ichiro Maeda, "Dynamic stability analysis on a Standard Dynamics Model with URANS method", 59th Aircraft Symposium, Dec. 2021

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	N/A
Number of Processes	64 - 128
Elapsed Time per Case	144 Hour(s)

- **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.02

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	556,500.77	0.03
TOKI-ST	666.44	0.00
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	25.91	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2](%)
/home	503.82	0.50
/data and /data2	41,208.95	0.44
/ssd	1,241.57	0.32

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2](%)
J-SPACE	71.91	0.49

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[*2](%)
ISV Software Licenses (Total)	0.01	0.00

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.